Bulk/Film Structural Comparison of Chalcogenide Glasses for Waveguide Applications

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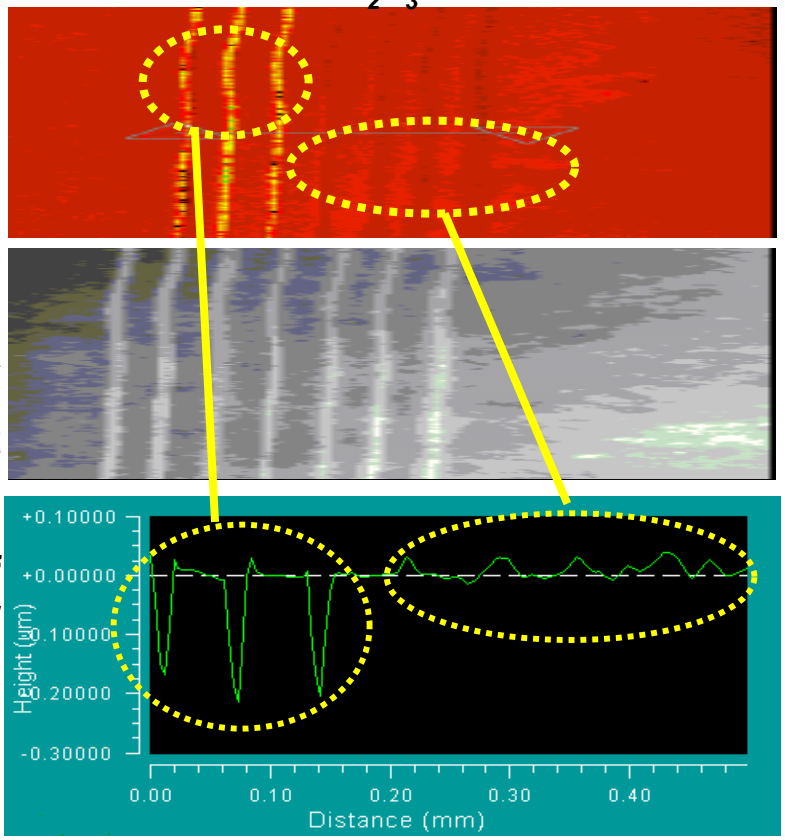
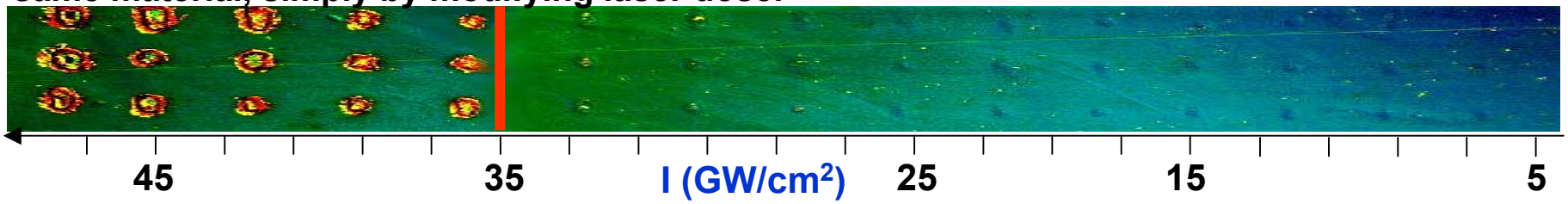
Next generation systems for telecommunication will use materials in bulk and thin film form to optically connect our homes to both local and world-wide sites. Current optical materials research is evaluating candidate materials that must be reliable, cost-effective and exhibit stable behavior over 10's of years. Chalcogenide glasses (ChG's) are a family of materials that can be easily tailored for their optical and physical properties. They can exhibit notable changes in structure when deposited as films, which can impact their properties and stability and possess photosensitivity which allows selective local modification to material properties with light. A fundamental knowledge and exploitation of such properties allows engineering flexibility in component design. Shown below is a micrograph illustrating the variation in topography of an As_2S_3 glass film when illuminated with near-bandgap light (λ=800 nm) of varying intensity (spot size ~10μm). The threshold laser intensity (denoted by the red line at I=35 GW/cm^2) defines the transition from photo-expansion of the glass structure (I < threshold) to ablation (I > threshold) in lines written in the same film at right. Such exposure response allows various structures to be fabricated in the same material, simply by modifying laser dose.

White light interferogram illustrates topographic relief from exposure above (L) and below (R) ablation threshold for an As_2S_3 film.





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Education

During this four year program, considerable progress has been made in the understanding of bulk/film structure-property variation in As-S-Se glass materials. In addition to multiple graduate theses, the program has supported more than 15 undergraduate research projects, both at UCF and with our INTL partners through UCF/CREOL and US-France INTL REU, and US-France *Collaboration in Science* programs. These results have been presented in over 50 faculty and student presentations, and have resulted in 20 refereed journal articles, book chapters or proceedings. Additionally, DMR funding has leveraged more than $1M in additional funding from other sources.

Outreach

US undergraduates have carried out work on ChG's and other Laser and Optical Materials research in France as part of the SoO's US-France INTL REU. Shown below (L) are attendees from our INTL REU workshop held at the Univ. Bordeaux in July 2003. At right, is Bryce Campbell, Iowa State University undergraduate presenting his research on oxy-sulfide glass synthesis at the workshop.